

## Are There Opportunities to Eliminate Early-Season Apple Scab Sprays?

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The generally accepted method for controlling apple scab in the northeastern U.S. is to begin fungicide sprays as soon as green tissue is visible. This is based on the observation that primary inoculum of the fungus that causes scab, *Venturia inaequalis*, begins to be released at about the same time that apple tree growth begins in the spring. If these spores infect, within approximately two weeks a new generation of spores is produced, each single infection having the capacity to produce hundreds of spores, and each of these can cause a new infection. This cycle repeats as long as there is sensitive apple tissue and wet weather, and without fungicides epidemics can explode, destroying fruit and defoliating trees. The earlier the first infections hit an orchard, the more cycles and more damage in an epidemic. In the face of this risk, growers try to start scab management at green tip.

Nearly 20 years ago, MacHardy and colleagues found that when they tracked the development of scab inoculum, it did indeed start to develop at around green tip, but that most primary inoculum did not start to mature until early pink through bloom. They asked the question, “If only a very small percentage of the potential scab inoculum is mature at green tip early pink, where the amount of overwintering inoculum is very low, can any early-season infection periods be left unprotected by fungicide?” The scab fungus grows in fallen dead leaves over the winter, but only if infections were present when the leaves fell in the fall. In an orchard where there is little or no scab on leaves in the fall, there will be little or no primary inoculum the next spring. Scab spores do not travel very far, about 100 yards at the most, meaning that without abandon trees near an orchard the only source of primary inoculum comes from infections in the orchard. MacHardy suggested that in “clean” orchards with very little scab, the risk of scab buildup is very low until a high percentage of the primary inoculum is mature, starting at pink or after three infection periods, whichever comes first.

Researchers NH developed a way of measuring scab inoculum in the fall, called potential ascospore dose or PAD. PAD evaluations are done in fall after harvest by looking at terminal shoots and counting any scab lesions on leaves. PAD level is related to the timing of scab risk the next spring. As would be expected, in orchards where PAD is moderate to high, significant risk of infection exists at green tip, but in orchards where PAD is sufficiently low the first scab fungicide can be applied after the first three infection periods or pink (whichever comes first) without risk of scab development.

Growers can also decrease the overall risk of scab by using sanitation in orchards, using urea applications or flail chopping leaves in the late fall or early spring. These treatments may be combined to be even more effective. Estimates indicate that sanitation can reduce the amount of primary inoculum (ascospores) in a block by 70% to over 90%.

Reducing scab inoculum will make any scab management program more effective than it would otherwise be. Even in apparently clean orchards, sanitation reduces risk from undetected late-season scab development. A less obvious benefit comes in the form of reduced chance of

resistance development. With less scab in an orchard, the odds that a mutant resistant to scab fungicides will survive and grow will decrease. Therefore, sanitation should be an annual practice in scab management programs.

It is interesting but understandable that sanitation and early-season fungicide delays have not been widely adopted. Both practices require work after harvest or in early spring, and may mean purchasing new equipment. At the same time, because scab has developed widespread resistance to DMI fungicides (Rally, Vintage, Procure, Indar, Inspire Super) and is developing resistance to strobilurin fungicides (Flint, Sovran), options to stop infections from developing into lesions are lacking. Growers and pathologists worry that if early-season scab infections develop, it will be difficult or impossible to prevent fruit damage.

Still, saving two or three fungicides in a year can save money and reduce pesticide use. If early-season fungicides can be eliminated without real risk of scab buildup it would be a useful tool in an IPM toolbox. With that in mind, we tested a conservative approach to delayed early-season fungicide applications in very low PAD blocks by delaying the first fungicide spray for scab until tight cluster or after two infection periods.

Of 14 blocks from 2008 to 2010 where early fungicides were delayed:

- 13 delayed blocks had fruit scab  $\leq$  non-delayed blocks;
- overall scab incidence 2.6% in delay blocks vs. 5.0% in non-delay blocks;
- mean delay of 8.4 days to tight cluster;
- from 1 to 2 infection periods prior to first spray;
- savings of 1 to 2 fungicide applications relative to the delay block.
- average time of approximately 30 min. to do a PAD assessment in a 1 to 3 acre block.

These results indicate that the risk of scab buildup in low-inoculum blocks where scab sprays were delayed was very low. Whether the savings of one to two fungicides justify the expense of a PAD analysis is a decision for individual growers. We can say that **a delay should never be done without doing a PAD assessment!** Complicating this picture is the observation that heavy use of DMI fungicides may mask active scab. An orchard may appear to be free of active scab on leaves in the fall, but the fungus will start to grow in fallen leaves when DMI activity and leaf resistance have disappeared. Based on this, we recommend limiting PAD measurements to blocks with two or fewer DMI applications used no later than bloom.

Regardless of whether growers are considering delayed early-season fungicide applications, we recommend that a sanitation program be used regularly. IPM was originally conceived largely as a way to delay pest resistance development. A cornerstone of IPM is that multiple tactics be used. In apple scab management, this means that relying strictly on fungicides for scab management is bound to generate more resistance problems than using other management options such as leaf chopping and urea applications in sanitation. Sanitation can directly reduce the risk of scab and reduce the long-term chance of resistance development.